NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

August 3, 1959

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

Hold for Release
Until Launched

No. 1
8/7/59

LAUNCHING VEHICLE

Consisting of three stages, the Thor-Able III rocket stands 90 feet high and weighs more than 105,000 pounds.

This is the first time a Thor-Able has been used to boost a satellite into an earth orbit. The upper stages are similar to but substantiallly modified from Vanguard upper staging.

Earlier versions of the vehicle were used in three space probes last year. The first of them blew up after 77 seconds because of malfunction in the Thor first stage (August 17, 1958). The second, labeled Pioneer I, rose to 70,700 miles and returned valuable data (Oct. 11, 1958). The third, Pioneer II, fell back after reaching 970 miles altitude when the third stage failed to ignite (November 8, 1958).

The first two stages of Thor-Able also have been used in a number of 5500-mile nose cone re-entry test flights.

Here is a breakdown of the stages and their functions:

First Stage:

Air Force Thor, intermediate range ballistic missile, minus guidance and modified to receive additional stages.

Weight -- Over 100,000 lbs.

Thrust -- Approximately 150,000 lbs.

The liquid-fueled Thor propels the vehicle for about 160 seconds after launch. During this period of time, the rocket is controlled by roll and pitch programmers.

Upon separation, the Thor re-enters the atmosphere and disintegrates.

Second Stage:

Powered by a liquid-fueled engine, the second stage was adapted and modified from earlier Thor-Able rocket vehicles. Eight small spin rockets are ringed around the outer skin of the stage. The second stage fires immediately after first stage separation.

Weight -- Over 4,000 lbs.

Thrust -- Approximately 7, 500 lbs.

Stage two propels the vehicle for about 100 seconds. At second-stage burnout, a plastic nose fairing covering the third stage satellite is jettisoned and falls away. Also at second stage burnout, eight spin rockets ignite causing the second and third stages and the payload to rotate at the rate of 168 revolutions per minute. The spin stabilizes trajectory of the third stage and payload, now on course. About a second and a half after the spin rockets fire, second-stage separation occurs. The second stage then falls and burns up on entering the earth's atmosphere.

Third Stage:

A solid-propellant rocket, the third stage was adapted from the Able I rocket vehicle. It propels the payload to orbital velocity, about 22,000 miles and hour and injects it in orbit.

Weight -- Over 500 lbs.

Thrust -- Approximately 3,000 lbs.

The third stage, which burns for about 40 seconds, coasts into orbit still attached to the payload. Separation occurs about 20 seconds after third-stage burnout when a set of springs forces the third stage and payload apart. Burned out, the empty third-stage casing weighs about 50 pounds.

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No. 2
8/7/59

EXPERIMENTS

The 15 major experiments in this 142-pound satellite, together with its advanced electronics, make it the most comprehensive scientific package the United States has attempted to put in an earth orbit.

The orbit alone -- programmed for 23,000 statute miles at apogee (farthest from earth) and 160 statute miles at perigee (closet to earth) -- indicates the complexity of the satellite's mission: To provide an extremely broad sampling of space information.

Such an elongated orbited is a product of launch angle plus speed, about 22,000 miles an hour or 4,000 miles an hour faster than needed for a nominal earth orbit. Each orbit should take about 12 hours.

Boosting the satellite into its highly elliptical flight path is a three-stage Thor-Able III rocket. Fueled and ready to go, the launching vehicle weighs more than 105,000 pounds and stands 90 feet high.

The body of the satellite is spheroid-shaped with a slightly flattened bottom. It is 26 inches in diameter, 29 inches deep and its aluminum skin is 1/16 of an inch thick. From its waist jut four paddles of power-generating solar cells. Hence the satellite's nickname, "Paddlewheel."

Most of the experiments ride bolted to a plastic and metal floor within the satellite. They break down into six main categories:

1 -- Three devices to map the radiation belt ringing the earth with each of the instruments concentrating on a specific radiation energy level.

2 -- A $2\frac{1}{2}$-pound scanning device -- something like a TV camera -- which is designed to relay a crude picture of the earth's cloud cover. Success of the camera experiment hinges not only on the operation of the instrument but on the motion and flight attitude of the satellite.

3 -- Solar cells, 8,000 in all or 1,000 on each side of the four paddles, to create voltage to recharge the satellite's chemical batteries in flight. The electronic gear in the satellite includes three transmitters and two receivers.

4 -- A micrometeorite detector built to guage the size and speed of meteoric particles hitting the satellite.

5 -- Two types of magnetometers to map the earth's magnetic field.

6 -- Four experiments to study the behavior of radio waves, all aimed at finding out more about deep space communications.

Depending on the satellite's success, similar instrumentation likely will be used in several deep space probes in the months ahead.

Work on the program began last November under a NASA contract to the Air Force Ballistic Missile Division (ARDC). In turn BMD subcontracted to the Space Technology Laboratories, Inc., of Los Angeles with STL providing overall systems engineering and technical direction over the payload, Thor-Able III launching vehicle and the tracking and communications network. Many of the experiments were devised by STL scientists.

To nonscientific eyes, the most striking feature of the satellite is the solar paddle system. These vanes, designed by STL, extend nearly three feet from the payload's aluminum skin.

They are made of pie-shaped sections of honeycomb plastic. Coverning the honeycomb are tiny silicon-based solar cells lined up in series to generate voltage. A glass filter shields each cell from harmful ultra violet rays while letting in the proper light. The cell causes a conversion of light energy into electrical energy.

During launch, the paddles which are mounted on pivotal aluminum arms with springs at the point where they join the satellite, ride folded downward birdlike under the payload. They spring up and lock in place just before third-stage ignition after a plastic jacket coverning payload and third stage is jettisoned.

In flight, the paddles are slightly cooked so they are exposed to maximum sunlight. Each paddle surface measures about 20 by 20 inches.

The solar cell system is designed to operate throughout the satellite's lifetime -- as long as a year. Solar cells were first sed successfully as a satellite power source in Vanguard I, launched March 17, 1958. A year and a half later now, the cells are still powering the transmitter sending Vanguard I's tracking signals.

One of the heaviest components of the satellite, the complete power supply system, including batteries, weights 30 pounds.

The three transmitters aboard duplicate each other in sending information on nearly every experiment, providing three-way back-up insurance. Two of the transmitters, operating at 108.06 megacycles and 108.09 megacycles, send analogue information.

This is a continuous wavering signal which is recorded on tapes and later graphed and analyzed.

A third transmitter, broadcasting at an undisclosed but ultra high frequency is the primary transmitter. It sends digital data or coded impulses which allow fairly rapid data translation.

In addition, there are two receivers. A low-frequency receiver will be used exclusively in one of the radio wave propagation experiments. A second high-frequency receiver can command 30 different functions in the satellite, including turning off and on the primary transmitter.

The main transmitter will be used only an hour and a half out of every six hours because it requires more power (40 watts) than the solar cells and batteries can supply. So on a command from the ground, the primary transmitter will be cut off while the solar cells recharge the batteries. The other experiments, including the other wo transmitters, need very little power -- less than a watt in most instances -- so they will continue to run as directed.

While the primary transmitter is off, memory units similar to those in high-speed computers will store instrument readings. This information will be transmitted in a matter of seconds when the main transmitter is turned on again.

Kick Rocket

A small solid-propellant rocket called a "kick" rocket forms the spine of the satellite. If needed, this 5-pound rocket will be fired to lift the perigee. If it appears the satellite will come too close to the earth on an early orbit -- under 100 miles -- the rocket would be triggered which should add 50 to 100 miles to the perigee pass.

Camera

Peeping out one side of the payload is a small open lens facsimile unit consiting of two parts: a tube containing a mirror which receives and focuses light and dark impressions, and an electronic counter which computes and records the impressions before they are converted into radio signals. This is another STL experiment.

In orbit, the payload is designed to spin about two revolutions a second to give it stability. Once per revolution the facsimile unit records what it sees. The signals it transmits will be educed to dots. A row of 128 dots will form a line and eventually the lines should form a picture. At best, the picture, in TV parlance, will be "snowy." Even under optimum conditions, it may take weeks to produce a picture.

If the satellite develops a wobbling or tumbling motion, the camera data will be useless. But such motions will not effect most of the other experiments.

Radio Wave Experiments

From 50 to perhaps 2,000 miles above the earth is an area containing free electrons and ionized particles. It is called the ionoshpere. It reflects low frequency radio signals from earth by literally bouncing most of them back. It plays a vital role in all radio transmission.

Signals of high frequency penetrate the ionosphere more easily but not without some detours and distortion. To improve deep space communications spanning millions of miles, scientists need to know more about the behavior of radio waves at various frequencies.

In this area are two experiments by STL, one by the National Bureau of Standards Laboratory at Boulder, Colo., and another by Stanford University at Palo Alto, Calif. The Stanford experiment calls for a very low frequency signal from a Navy transmitter in Annapolis, Md., to the satellite where it will be rebroadcast to tracking stations.

Magnetometers

Closely related to the radio propagation experiments are two devices designed to map the magnetic field blanketing the earth from pole to pole.

Electrical "storms" occur withing this field which, in theory, extends thousands of miles beyond the ionosphere. But what are the boundaries of the magnetic field? What causes those storms? How do they effect our compasses and other magnetic tools on earth? What effect does this field have on communications?

Two magnetometers constantly gauging the field's electrical strength -- one perpendicular and the other horizontal to the satellite's spin axis -- may provide answers to at least some of these questions. Both magnetometers were designed by STL. Together they weigh a little over three pounds.

Radiation Counters

Radiation counters provided by the University of Chicago, the University of Minnesota and STL are to measure three energy levels in the Great Radiation Belt.

The counters will measure the kinetic energy or the velocity and mass of infinitestimal particles ranging from alpha through X-rays. This energy factor is rated in terms of millions of electron volts (MEV).

The four-pound University of Chicago experiment will guage the radiation bombardment of high-energy particles. Instrumentation consists of six gas-filled cylinders ranged around a seventh cylinder. The total bundle, plus a lead shielding, measures about two inches square. The inbound particles will ionize the gas creating an electrical impulse as they penetrate one or more cylinders, depending on their potency.

The medium-energy University of Minnesota experiment is a combination of two instruments, a gas-filled ion chamber to provide the energy information and a Geiger-Mueller tube to count the number of particles passing through. It weighs two pounds and rides in a four-inch square box.

The STL unit, weighing three pounds, will probe the low-energy part of the spectrum. Here the particles will pass through a crystal which will create a small burst of light. In turn the intensity of the light will be transformed in a signal. Because of the light-twinkling effect, this eight by two-and-a-half-inch cylindrical device is called a Scintillometer.

The radiation instruments are designed to compliment each other. In view of the satellite orbit, the three devices should permit a fairly complete mapping of the extent and intensity of the radiation belt which poses the single biggest hazard to manned interplanetary flight.

Micrometeorite Detector

Two shiny curved plates of metal between the arms of the solar paddles on opposite sides of the satellite should tell scientists more about the density and patterns of micrometeorites.

Behind each plate is a microphone. When a micrometeorite hits a plate, the microphone senses the collision and transmits it as a voltage.

The experiment, designed by the Air Force Cambridge Research Center, weighs less than a pound.

Tracking

A host of United States tracking outposts will take part in tracking this satellite but the principal command and data reception points will be:

Jordrell Bank, a 250-foot tracking dish in Manchester, England, 60-foot dishes in Kalae, Hawaii and Millstone Hill, N. H., and smaller dishes plus other types of antennas at Singapore, Malaya, and Cape Canaveral, Florida.

All of these points are tied together on a teletype circuit, the control point of which is STL's Space Navigation Center in Los Angeles. Into STL will be channeled early trajectory readings. After analyzing these, STL will be able to advise the various stations around the world as to when and where they should point their antennas to pick up the satellite.

The telemetered experimental information will be partially reduced at the tracking sites before moving to STL for further interpretation.

Guidance in the booster vehicle is by programmed autopilot. Precise tracking information will be furnished by lightweight transponders in the second stage as well as the payload. Transponders receive a tracking signal from the ground and in effect bounce it right back by re-broadcasting it. The change in pitch of the signal re-broadcast tells with high accuracy where the payload is and where it is headed.

Other Devices

In addition to the experiments detailed, there are a number of devices in the payload which will be checking on the performance of both the vehicle and the satellite instrumentation.

Among them is an angualr accelerometer which will monitor the "tipoff" angle -- the shift caused by the stages as they drop off. It will also tell if the satellite develops a tumbling or a wobbling motion.

Other devices will relay information on the satellite's temperature, internal and external.

A voltage guage will be measuring the output of the solar cells. If needed, a switch can be commanded which will change the battery charging rate.

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CONTRACTORS

More than 50 scientific and industrial firms under the technical direction of Space Technology Laboratories, Inc., Los Angeles, participated in the development of this satellite program.

Principal contractors and subcontractors are:

Atlantic Research Corporation, Alexandria, Va.; Engineered Magnetics, Hawthorne, Calif.; Gilfillan Bros., Los Angeles, Calif.; Hallamore Electronics Co., Anaheim, Calif.; Hoffman Electronics Inc., Evanston, Ill.; Motorola, Inc., Phoenix, Ariz.; Radiation, Inc., Melbourne, Fla.; Rantec, Inc., Calabasa, Calif.; Space Electronics Corp., Glendale, Calif.; Stanford University at Palo Alto, Calif.; the University of Chicago, at Chicago, and the University of Minnesota at Minneapolis.

Here is a breakdown of major contractor responsibility:

First Stage (Air Force Thor IRBM)

1. Propulsion systems -- Rocketdyne, Division of North American Aviation.

2. Airframe, control, electrical, and instrumentation systems -- Douglas Aircraft Company.

3. Assembly, integration, checkout, and launch -- Douglas Aircraft.

Second Stage

1. Propulsion system and tanks -- Aerojet-General Corporation, a division of General Tire and Rubber Co.

2. Control, electrical, instrumentation, engine shutoff, and spin rocket systems -- STL.

3. Assembly, integration, and checkout -- STL.

Third Stage

1. Rocket motor -- Allegany Ballistics Laboratory of Hercules Powder Co.

2. Structure and electrical -- STL.

3. Assembly, integration, and checkout -- STL.
   Payload -- STL.

Launch Operations

1. Pad, test, checkout -- Douglas Aircraft

2. Launch crew -- Aerojet-General
Douglas Aircraft
Rocketdyne
STL

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No. 5
8/7/59

PROJECT OFFICIALS

Principal NASA officials involved in this program are Dr. Abe Silverstein, director of Space Flight Development, and Dr. John Lindsay, head of the solar physics program of the Space Sciences Division.

Key BMD-STL personnel in the program are Major General O. J. Ritland, commander of the Air Force Ballistic Missile Division; Dr. Ruben F. Mettler, STL executive vice president and senior project advisor; Colonel Richard D. Curtin, AFBMD deputy commander for ilitary Space Systems; Dr. George E. Mueller, STL vice president, associate director of the Research and Development Division, and senior project advisor; Lt. Colonel Donald R. Latham, AFBMD director of Space Probe Projects; Dr. Adolph K. Thiel, STL director of advanced Experimental Space Missions and project director; and Major John E. Richards, AFBMD chief of the Astro-Vehicles Division within the Space Probes Directorate.

General Ritland, who was recently promoted to two-star rank and who assumed command of AFBMD in April of this year, attended San Diego State College for three years before beginning his Air Force career as an aviation cadet in 1932. Since 1939, when he was assigned to Wright Field in Dayton, Ohio, as a test pilot, General

Ritland has been in the test and development field with the exception of a war-time overseas tour. From 1956 until April of this year, General Ritland served as the Vice Commander of AFBMD to Lt. General Bernard A. Schriever, now the Commander of the Air Research and Development Command.

Dr. Silverstein joined the National Advisory Committee for Aeronautics, NASA's forerunner, in 1929 after receiving his B. S. in mechanical engineering from Rose Polytechnic Institute, Terre Haute, Ind. From the same school he received a mechanical engineering professional degree in 1934. In 1958, he was awarded an honorary doctorate by Case Institute of Technology of Cleveland, O. Before moving to his present job at NASA headquarters in Washington, D. C., he served as associate director of NACA's Lewis Flight Propulsion Laboratory in Cleveland.

Dr. Lindsay transferred to NASA in November, 1958, from the Naval Research Laboratory in Washington. He received his bachelor's degree in physics from Guilford College, N. C., and his master's and PhD in physics from the University of North Carolina.

Dr. Mettler received his B.S., M.S. and PhD degrees in electrical and aeronautical engineering from the California Institute of Technology. He presently serves on a special committee of the Air Force Scientific Advisory Board and has served as a special consultant to the Assistant Secretary of Defense.

Colonel Curtin, a 1939 graduate of West Point and holder of a M.S. degree from the University of Michigan (1950), has been at AFBMD since February 1958. He has served as the Chief of Staff for the 17th Air Force in North Africa and Turkey; Director of War Plans at Headquarters, USAF; and Executive Officer, Weapon Systems, at Headquarters, Air Research and Development Command.

A member of the German missile team that developed the V-2 rocket, Dr. Thiel received his M.S. and Phd degrees from the Institute of Technology at Darmstadt, Germany. He has served as principal advisor to the Army Ordnance Corps on technical matters of missile systems planning development and is a former member of the Army Ordnance Guided Missile Advisory and Evaluation Committee.

Dr. Mueller, Able III Senior Project Advisor, received his B.S. degree at the Missouri School of Mines, an M.S. degree in electrical engineering from Purdue University and his PhD. in physics from Ohio University. For more than ten years he taught at Ohio State as a professor of electrical engineering and has patents in the fields of electron tubes and antennae.

Lt. Colonel Latham entered the service in 1941 and won his pilot's wings in 1942. He left active duty in 1945 to return to college, gaining a B.S. in aeronautical engineering from the University of Michigan in 1948. Later that year, he rejoined the Air Force and served in several engineering capacities until his assignment to AFBMD in February 1955. In December 1957, he was directed by General Schriever, then Commander of AFBMD, to organize Project Able.

Major Richards, a 1945 graduate of West Point, also holds a M.S. degree in aeronautical engineering from M.I.T. After graduating from M.I.T. in 1951, Major Richards served at Holloman AFB, New Mexico, as a project officer on various drone missile projects for four and a half years. In 1955, he was transferred to AFBMD, where he has served in several offices.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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For Immediate Release
August 17, 1959

NASA LAUNCHES EXPERIMENTAL CLOUD 150 MILES HIGH

The first of two Nike-Asp sounding rockets designed to provide basic geophysical information on wind activity was launched at 5:18 a.m. (EDT) today from the National Aeronautics and Space Administration's Wallops Station, located on Virginia's Eastern Shore.

The rocket ejected a trail of sodium vapor which began at an altitude of about 50 miles. It extended to a peak of about 150 miles. In the morning twilight it produced a huge orange-yellow cloud visible over a large area of the Eastern Seaboard. The cloud then drifted inland and was seen as far south as Vero Beach, Florida, and as far north as Pittsburgh and Dayton.

Scientists photographed the phenomenonfrom five stations, and from data obtained they will be better able to study wind velocities and directions plus diffusion in the upper atmosphere.

Clear weather conditions during a twilight period are necessary for the sodium cloud experiments, since optical tracking is required from widespread stations. The second firing in the series will be held later this week, again depending on weather conditions.

Tentatively, the second launch will be held at 8:35 p.m. (EDT) Tuesday, August 18. Scientists then will compare data obtained from both morning and evening twilight experiments.

The 27-foot Nike-Asp is a two-stage solid-fuel booster using the Army's Nike as first stage and the Cooper Development Corporation Asp as the second stage. The Nike-Asp has a gross takeoff weight of 1,550 pounds.

The 75-pound payload contained about 10 pounds of sodium pellets mixed with a thermite compound. The sodium-thermite mixture burned and the resultant exhaust was the vapor trail and cloud.

The trail was photographed by cameras using special filters at the Fleet Air Defense Training Center, Dam Neck, Virginia; Camp A. P. Hill, Bowling Green, Virginia; Andrews Air Force Base, Maryland; Dover Air Force Base, Delaware, and at Wallops Station.

Payload packaging, tracking and data reduction are responsibilities of the Geophysics Corporation of America, Boston, which is operating under a NASA contract. A NASA firing crew launched and radar tracked the vehicle from Wallops.

The yellow-orange sodium vapor, which gives off a glow when excited by sunlight, was visible about 30 minutes over a several hundred-mile area of the Eastern Seaboard. The appearance was the same as that of sodium vapor lamps used by many cities as street lights.

Maurice Dubin of NASA's Space Sciences Division, Washington, who is project chief for the experiment, explained that use of the Nike-Asp booster system allows scientists to observe wind phenomena over a much higher altitude range than was possible before. Use of balloons, chaff and parachutes and tracking meteor trails provided information up to altitudes of about 50 miles. In 1956, the Air Force conducted sodium cloud experiments over New Mexico with the Aerobee rocket, reaching altitudes of about 80 miles.

Shortly after today's experiment, all tracking stations reported good photographic conditions for periods ranging from 10 minutes to 30 minutes. The stations used various camera arrangements for photography exposing from five to 10 frames per second.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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RELEASE #59-201
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For Immediate Release
August 15, 1959

EARLY EXPLORER VI FINDINGS

Samplings of early data from Explorer VI, launched August 7, indicate the satellite's signals are generally strong and clear. But scientists say it is much too early to try to draw firm conclusions from the fragmentary information.

The satellite has covered more than 1.5 million miles since it was launched from Cape Canaveral, Florida. It takes about 12½ hour to circle the earth in its highly elongated 91,000-mile orbit which carries it out as far as 26,400 miles and in as close as 156 miles from the earth.

Officials of the Air Force Ballistic Missile Division and Space Technology Laboratories, Inc., major contractors of the National Aeronautics and Space Administration on the satellite, are processing the telemetered information to make it readily useful by the scientists whose experiments are in the satellite. The data are being relayed to STL data reduction center from tracking stations around the world.

Here are some of the indications from the early data:

Radiation -- The University of Chicago, University of Minnesota and STL experiments measuring radiation should provide a more exact mapping of the doughnut-shaped radiation belts ringing the earth. Earlier Pioneer payloads indicated the radiation area started at about 600 miles and extended to some 35,000 miles from earth with peak intensities at 2,500 and 10,000 miles

The advantage of Explorer VI over space probes in radiation studies is: Explorer VI makes two round-trips a day through the belts while the space probes make only one pass on a one-way trip outbound.

Thus far, data from the radiation instruments appear to confirm some facts and considerable theory about the structure of the radiation spectrum. Also, very low energy particles in the radiation belts are being measured for the first time with a device called a scintillometer, designed by STL.

Micrometeorites -- In the first two days of orbit (through Sunday afternoon), Explorer VI was hit by 28 micrometeorites -- particles no bigger than a speck of dust. The impact rate indicates the presence of one micrometeroite in a volume about the size of the Empire State building.

Facsimile system -- The facsimile device, built to provide a crude picture of the earth's cloud cover, is operating. Tapes of its signals are being flown to a Los Angles control center for final reduction. Scientists say it will be several weeks before they will know whether they will have a picture.

In radio wave experiments, "solid" signals and reception are reported but they will require detailed analysis as will the readings from the two magnetometers aboard.

The satellite is running well within its designed temperature range -- 25 degrees F. to 115 degrees F. The orbit of the 29-inch aluminum spheroid carries it 47 degrees north and south of the equator.

The solar cells mounted on the satellite's four paddles are supplying about nominal current to recharge the batteries powering the payload's electronics.

As yet no decision has been made as to when or if the small "kick" rocket riding in the center of the satellite will be fired. Presently, the orbit is such that no extra kick is needed to keep it from burning up on grazing the earth's atmosphere.

Tracking stations at Cape Canaveral, Millstone Hill, N. H., and Manchester, England, have at times triangulated simultaneously on the satellite from its radio signals to obtain precise tracking data.

The Smithsonian Astrophysical Observatory reported that its camera tracking team at Arequipa, Peru, photographed the empty third stage Explorer VI rocket casing early Tuesday. The casing was about 5,000 miles high when the picture was snapped. The photo should be available in about three weeks after the casing has been plotted precisely against a celestial background.

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For Release:
Friday, P.M.
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NASA ESTABLISHES BIOSCIENCE ADVISORY COMMITTEE

To assist in determining the nature and extent of future NASA activity in those aspects of the life sciences concerned with manned space flight and the effects of extra-terrestrial environments on all forms of life, a Bioscience Advisory Committee has been established by T. Keith Glennan, Administrator.

The Committee will study current U. S. capability in space-orientated life science research and development; outline the scope of present and future problem areas in the space bioscience field; and then recommend the part NASA should play in future bioscience activity related to the national space program.

Chaired by Seymour S. Kety, Chief of the Laboratory of Clinical Science, National Institute of Mental Health at Bethesda, Maryland, the committee is composed of outstanding bioscientists. Members are: Wallace O. Fenn, Professor of Physiology at the School of Medicine and Dentistry, University of Rochester, Rochester, New York; David R. Goddard, Director of the Division of Biology, University of Pennsylvania, Philadelphia, Pennsylvania; Donald G. Marquis, Professor of Psychology at Massachusetts Institute of Technology, Cambridge, Massachusetts; Robert S. Morison, Director of Medical and Natural Sciences, Rockefeller Foundation, New York; and

Cornelius A. Tobias, Professor of Medical Physics, University of California, Berkeley, California.

Dr. Clark T. Randt, NASA Scientist for Space Medical Research, has been appointed Executive Secretary to the Committee.

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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For Release
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Statement by

Dr. T. Keith Glennan, Administrator

National Aeronautics and Space Administration

before the

4th USAF BMD Symposium on Missiles and Space Technology

Los Angeles, California

August 24, 1959

It is my purpose this morning to discuss with you some of the conclusions that we of the National Aeronautics and Space Administration have reached after almost a year of operation. There could be no more appropriate forum for such a discussion than this Fourth Technical Symposium on Ballistic Missiles and Space Technology. The members of this audience represent a solid core of the science-industry-Government team that is responsible for the achievements of our national space effort to date. I hardly need add that you make up the team upon which the vital space work of the future must depend.

There is a tried and true formula for speech preparation that runs something like this--tell them what you are going to say--say it--and then tell them what you have said. I am going to attempt to follow that format this morning as I speak out on basic problems that confront us--problems that are common to all who labor in these missile and space technology fields.

Specifically, I want soberly to examine with you the present state of the art in these fields. While I yield to no one in the extent of my enthusiasm about the future in this business, I will not be painting a rosy, pie-in-the-sky picture of manned space transports, civilian colonies and manned military bases on the moon or other planets, warehouses in space and the like. There seems to be a contest going on in this country in which substantial numbers of people are attempting to outdo each other in predicting exotic accomplishments in space in the next few years. In my opinion, there is need for more common sense and good technical judgment to be injected into this picture. While there are others more able than I to handle such an assignment, my position as Administrator of NASA compels me to state my convictions in these matters as part of my responsibility of keeping the Congress and the public fully and currently informed.

As you know, it was just one year ago last month that the President signed the bill establishing the National Aeronautics and Space Administration. Building on the foundation of organization, personnel, plant assets, programs and problems transferred from the NACA, ARPA and the military services, NASA was a going concern from the day we announced that we were in business, the first of October 1958. We lacked, as did all of the others engaged in the space business, a full realization of the complexity of the technological problems facing us. And we were neophytes--probably still are--in our understanding of the costs to be incurred in a hard-hitting, broadly-based national space program. But we had--and we still have--enthusiasm and real zeal for the great adventure that still lies before us: the discovery of new knowledge about our universe and the application of that new knowledge and supporting technology for the benefit of mankind everywhere.

Now, what have we learned from our successes and failures of the past year? And what are we planning for the future as a result of our experiences--both good and bad? Remember, please, that I am speaking about the civilian space program--not the military program. However, they are closely related--and are inter-dependent in many ways and it is probable, therefore, that some portion of my remarks may have applicability in the military area, as well.

In the first place, we have learned that we are not nearly as far advanced in space technology as we had thought or hoped. Our experiences in the space vehicle field have been less than completely satisfactory. The ratio of successful launches to what has been termed by some as "successful failures" has not improved very much in the past year. And as soon as we began to plan for second generation experiments we found that we were facing some hard facts of life in the propulsion and guidance fields. Even today, every shot we make--either by the military or by ourselves in NASA--is a shot in which there is little or no margin for even a slight deviation from planned performance parameters. In thrust capability, in guidance-injection, mid-course and terminal,--in thrust control--in all of these areas there is much that must be learned and applied before we undertake the difficult missions we all talk about so glibly.

Secondly, it is becoming clear that we cannot and should not attempt to undertake all of the hundreds of projects that are being recommended to advance our understanding of the space environment. We haven't the manpower, the facilities or the funds. More important than any of these, however, is the fact that it seems to me that we will make progress faster if we move at a rate that will enable us to understand a bit more about the things we have already done and the information we have already acquired from successful experiments that are behind us.

Probably more than any other single matter, the question that plagues all of us is one of reliability. When will we be able to count on being successful in launching and placing into orbit or on the desired trajectory in deep space as many as three out of four of our intended experiments? We should admit, quite frankly, that with distressingly few exceptions, we have not achieved complete success in any mission to date--success in the sense that the payload has been injected into orbit or into a deep space trajectory within reasonable limits of the planned flight objectives and in the sense that the payload has performed its mission satisfactorily.

Now lest you think I am being unduly harsh, let me hasten to say that our competitors in the USSR have reported only their successful flights to date. We know they have had failures. We don't know, in any instance, whether even their announced successes have really come any closer to the intended objectives than have ours. And I am mindful of the truly great accomplishments that the United States has managed in the past two years in the space field. Indeed, I am proud to be one of those associated in a responsible way with this national effort where success or failure may well have implications far beyond the immediate civilian or military utility of the experiments we attempt.

We are the one nation in this world which has developed its position of leadership through the application of science and technology to the alleviation of man's back-breaking burdens while continuing to protect the rights of the individual citizen. For us to play second fiddle in this space business is to admit that we have lost a part of our genius for experiment--for taking a competitive risk--for searching out new facts about nature that ultimately will improve the well-being of mankind everywhere. No, we cannot and I am sure we will not fail to demonstrate once again that free men--when challenged--can rise to the heights and overcome the lead of those who build on the basis of the subjugation of the rights of the individual as they dictate to him the path he must take in response to the demands of the state.

Now that may seem to be a bit of histrionics to the sophisticates in this audience but it is the creed by which we must guide our actions in the days ahead. And we are not going to achieve our goals by wishful thinking about difficult technical problems.

But I'm afraid I'm being carried away by my own convictions about the basic capabilities that reside in our people while the realities of this business await attention. Having told you very, very briefly about the more important bits of realism that have been impressed upon us during the past year, let me now tell you something of our thinking about the future.

First, as to program--we have had to face up to the fact that we simply cannot do everything that is proposed either by members of the scientific community, other agencies or by our own people. Some of the firing schedules we developed nine months ago lacked the realism that now characterizes our planning.

Within the next year, I think you will be able to note an orderliness about the attack our people will be making in the space sciences area. Thus far we have been engaged in completing experiments planned for the IGY. In fields such as astronomy, meteorology and the physical sciences, we are developing a determined and well planned program. Lead times for most of these experiments will be long and will call for continuing high levels of effort and support. Unless we can achieve this goal, we will lack, ultimately, the underpinning for the entire space program and may miss the really important discoveries that now lie hidden from our view.

We plan to concentrate our initial efforts in deep space on lunar missions--near miss, orbitting and hard and soft landings of payloads. In this program we will develop the techniques necessary to accomplish missions into deeper space and will use them for such missions as their reliability and the opportunity permits.

Second--as to basic research and advanced technology--we expect to support greater effort in the universities, other non-profit institutions, and in industry in both basic research and in advanced development of systems components. In the development of better methods and devices in the fields of guidance, control, telemetry, auxiliary power units and sensors of all types--in all of these areas, we see the need for greater concentration of effort. Through such actions we hope to improve the reliability of the systems which will employ these components.

Third--as to booster systems--it is becoming increasingly apparent that greater efforts must be placed on simplification and reliability. As a corollary, it seems quite clear that continued attention must be given to reduction in the number and varieties of rockets and rocket booster systems for use in the space business. It is unlikely that these systems will become off-the-shelf production items in the foreseeable future. With limited numbers of firings in prospect, reliability can be expected only if the variety of systems is kept at a minimum. It will be cheaper to waste payload space in using an oversize booster that becomes reliable through continued use than to tailor boosters for each specific mission with the attendant lowered reliability that surely will result from infrequent use.

As we move ahead in our program, using newly developed vehicles of larger size and with more stages, the problems of achieving successful flights will increase. Recognizing the statistical success thus far achieved with the single- and two-stage missiles and the number of firings required in their development period, we must ask the question as to the probable success of a seven-stage vehicle required to land a man on the moon and return him to Earth. Clearly, major advances in research and development techniques leading to greater vehicle reliability must be accomplished. Both the cost and development time will be prohibitive if vehicle development depends, as it does now, so heavily on "trial by fire." As a part of our program we are currently studying methods for development that might lead to earlier success of our flight vehicles, and the progress we make here may well determine how long it will take to do the advance missions that we are all so anxious to accomplish.

Finally--as in most other advanced technologies--a vast new area of materials research is being opened up by our space exploration requirements. As you well know, many materials exhibit different properties when used in radiation fields and in the vacuum of space. These materials must be improved or other materials found or developed to replace them. Magnesium, for example, sublimates in a vacuum--and effectively disappears. Another phenomenon--two moving metal surfaces in a vacuum tend to weld together by molecular adhesion. Our engineers and scientists are facing many such problems, but the list is far too long to catalogue here.

My point is simply this: we have used up much of our missile technology. We have drawn heavily on our capital--the knowledge and experience accumulated by the military services, by industry and by NACA and others over the past 10 years or so. We must replenish that capital with new knowledge. From here on out, space research is going to be a matter of the same determined plugging away that has characterized aeronautics research--and, indeed all scientific endeavor.

As for Russian space achievements, we have learned that while they use their successes effectively for propaganda--and are able to hide their failures--their public claims have been, to the best of our knowledge, factual. Their scientists, however, are not the giants they would have us believe--they simply started working in this particular field six or seven years before we did. It would be tragic if we had to admit they were working harder today than we. But they have set for us some targets by the success of their efforts thus far announced.

For instance, while we have no information which lead us to believe that the Russians have solved all of the guidance problems I mentioned earlier, obviously their guidance is good and obviously they are not standing still.

One of the most sensible men in our business today is my good friend, Dr. Lee DuBridge, President of the California Institute of Technology. I presume that most of you have read his article in the August issue of Harper's Magazine. I think that he offers the most reasonable analysis of our present situation that I have seen lately.

Dr. DuBridge reminds us that conditions in space are completely outside all human experience up to now. He points out that the essential elements that sustain life--among them air, water, and food, as well as fuel for the craft--are missing. All these things, including instruments and other kinds of equipment, will have to be carried along with the astronaut, creating the biggest problem in logistics that has ever faced an expedition into the unknown.

Dr. DuBridge goes on to say that at the presently unattainable rate of 93,000 miles per hour--the speed required to overcome the gravitational attraction of the Sun--it would take three weeks to arrive at Mars, more than three years to visit Neptune, and 28,000 years to reach Alpha Centauri, the nearest star.

He emphasizes that maneuvering in space calls for totally new techniques of motion. No object in orbit can overtake another one, or lie in wait for it. Instead, it must be intercepted by a trajectory based on complex calculations, and on adjustments in course and speed of the utmost exactness.

The energy requirements for space vehicles are most formidable, and Dr. DuBridge cites the problem of sending a single man with a minimum amount of equipment (weighing in all about 1 ton) on a trip to the Moon and back. A rocket with about 300,000 pounds of thrust-and we have such rockets--will carry him to the vicinity of the Moon. But the weight of fuel needed to land him on its surface will treble the necessary thrust, raising it to 900,000 pounds. To bring him back and land him safely on the Earth increases this to at least 5,000,000 pounds of thrust--several times the amount provided by the biggest single rocket engine now under development by NASA.

In spite of these difficulties, and others equally challenging to engineers and physiologists, Dr. DuBridge is not discouraged; nor am I. We share the belief that space exploration by mankind within the Solar System is both feasible and necessary--that it is indeed inevitable--and that it may offer rewards enough, in knowledge and in practical benefits yet unknown, to keep humanity occupied for the next hundred years. We recognize that the total cost will be colossal, but that the unforeseen--and unforeseeable--dividends, spread out over the years, will justify the cost.

Some Americans, as I and no doubt many of you have learned, have quite a different outlook. The other morning I had breakfast in the coffee shop of a Washington hotel. Two men were at an adjoining table. One was in a table-banging temper. When he mentioned what he called "this space folderol," I naturally pricked up my ears. I confess that I eavesdropped a little, which wasn't hard since he had a powerful voice and made no attempt to lower it.

Among other things, he said--and I quote--"We had a three-inch rain in Washington last Saturday. So what happened? The drains need working over so badly that a good deal of the city was flooded. People had to swim away from their cars.

"Now," he went on to say, "with a situation like that, right here in Washington, why in the name of common sense are so many millions being spent on such nonsense as shooting a lot of hardware to the Moon? Who cares about the Moon? There's plenty to do down here without wasting money on things like that."

There is of course, a fundamental difference between solving the problem of overloaded storm drains and sewers in Washington and conducting research and development in space. For the drainage problem there is a ready solution needing only money to complete the loop. Research in space and the development of useful applications of knowledge gained through that research requires imagination, courage and lots of money. It may well prove to be one of the most exciting and profitable ventures of all time. But it is so easy to be carried away by our own enthusiasms to the point where we begin to ignore realities. It is obvious that the man I overheard is not convinced that research, and particularly research in space holds much promise for him.

Naturally, I do not agree with the gentleman's opinion about this matter. I do, however, concede that he had a right to his opinion and I am afraid that there are many others like him--persons who are less than excited over trips to the Moon and the building of way stations in space. Our problem--yours and mine--is to be as responsible as possible in our public utterances in this field. Overstatements of wonders that are to come may be exciting to some people--but I seriously doubt that those on whose understanding we must depend for continuing support will be thus convinced.

Speaking of support--you will note that I have said nothing directly about costs. That is a story in itself with which most of you have some familiarity. I would say only that space program costs will increase substantially in the years ahead if we are permitted to carry out the programs now believed to be desirable and necessary in both the civilian and military fields.

If you term this a sobering picture, I have made my point. But I do not intend it to be a pessimistic one. Our horizons will be bounded only by the limits of our imaginations, our ability to perform responsibly the tasks we undertake and by our ability thus to convince the Congress and the public of the worth and urgency of our programs. It is high adventure we are experiencing--let us be worthy of our trust.

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WILLIAMS NAMED TO NASA'S PROJECT MERCURY TEAM;
BIKLE TAKES OVER DIRECTION OF HIGH-SPEED FLIGHT STATION

Walter C. Williams, Chief of the NASA's High-Speed Flight Station at Edwards, California, has been named an Associate Director of Project Mercury. The Mercury program is designed to put a manned space capsule into a controlled orbit around the earth and return it safely. Williams' successor at the High-Speed Flight Station is Paul F. Bikle, Technical Director of the USAF Flight Test Center, Edwards, California. Both appointments are effective September 15.

The new assignment will take Williams to Langley Research Center, Hampton, Virginia, where NASA's Space Task Group administering Project Mercury, is located. He will be responsible for launching command, range, data acquisition, and recovery operations connected with the program. Williams will report to Robert R. Gilruth, Project Director. Charles J. Donlan, former Assistant Director of the program, has been named an Associate Director responsible for the technical development aspects of the Mercury project. Donlan will continue to report to Gilruth.

Williams, 40, has been responsible for the high-speed flight research efforts at the NASA station in California since it was established in 1947. These flight investigations have concerned many of the nation's most advanced experimental aircraft, including all of the research airplanes from X-1 to X-15 and the D-558 series.

A native of New Orleans, Louisiana, he was awarded a Bachelor of Science degree in Aeronautical Engineering from Louisiana State University in 1939. After about a year with the Glenn L. Martin Company, he joined the National Advisory Committee for Aeronautics, the predecessor of the NASA, at the Langley Research Center in 1940.

In 1946, Williams was made X-1 aircraft project engineer and was sent to Muroc (now Edwards) Air Force Base. One year later he headed up the newly established NACA flight station nearby.

Williams is an Associate Fellow of the Institute of the Aeronautical Sciences and a member of the flight test panel of NATO's Advisory Group for Aeronautical Research and Development.

Mr. and Mrs. Williams and their three children now live in Lancaster,California. They will move to the East Coast in the near future.

Bikle, born in Wilkinsburg, Pennsylvania, in 1916, earned a Bachelor's degree in Aeronautical Engineering from the University of Detroit in 1939. Except for a short time with Taylorcraft Aviation Corporation, Alliance, Ohio, he has been associated with the U.S. Air Force as a civilian scientist since leaving school.

He was appointed Chief of the Aerodynamics Branch in the Flight Test Division at Wright-Patterson Air Force Base in 1944. Three years later he was named Chief of the Performance Engineering Branch, responsible for conducting flight tests of new aircraft, including the first jet bomber. In 1947, when his section was transferred to the Air Force Flight Test Center at Edwards, he was made Assistant Chief of the Flight Test Engineering Laboratory.

In 1954 Bikle was appointed Technical Director of the Directorate of Flight Test at the Air Force Facility. One year later he was named Technical Director of the Flight Test Center, a position he has held up to this time. In this capacity, he has been responsible for the engineering and scientific activities of the Center including flight test, missile test, and parachute development testing.

A pilot in his own right in both powered and gliding aircraft, Bikle has won a number of competitive flying awards. He is an associate fellow of the Institute of the Aeronautical Sciences; a member of the American Rocket Society and the Instrument Society of America; and Director of the Soaring Society of America.

Mr. and Mrs. Bikle and their four children live at 44926 Raysack Avenue, Lancaster, California.

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